Remarks

Claims 1-22 are pending. Claims 1-17 stand rejected for obviousness and claims 18-22 have been withdrawn from consideration. Applicants respectfully request reconsideration of the rejected claims in view of the amendments and the following remarks.

§ 103 Rejections

Claims 1-17 stand rejected under 35 USC § 103(a) as being unpatentable over Botman et al (Nuclear Instruments and Methods in Physics Research B 139) either alone (claims 1, 2, 5, 10-13, 16, and 17) or in view of WO 00/04055 (claims 2-4, 6-9, 14, and 15). Applicants respectfully traverse this rejection.

In order to establish a *prima facie* case of obviousness, the Patent Office must demonstrate that (1) there is a suggestion or motivation in the prior art to modify or combine reference teachings, (2) one skilled in the art would have had a reasonable expectation of success in making the modification or combination, and (3) the prior art reference(s) disclose all of the claim limitations. MPEP 2142.

In an Office Action mailed February 3, 2004, the Examiner asserts that Botman discloses the heterogeneous polymerization in a single phase of monomer such as methyl methacrylate (MMA) applied to seed latex, and also describes the homogeneous polymerization of styrene using an e-beam. The Examiner acknowledges that Botman fails to describe the polymerization of styrene or MMA using a dose per pulse of about 10 to about 90 Gy, as recited in independent claim 1. However, the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have achieved polymerization of MMA or styrene in this range through the application of the formula $D = F \cdot dpp \cdot t$. In particular, the Examiner states that "It is well known in the art that radiation polymerization of unsaturated compounds depends mainly on total dose, and the total dose (D) depends on pulse frequency (F), dose per pulse (dpp) and residence time (t)." According to the Examiner's reasoning, since Botman describes that polymerization of MMA can be achieved at a total dose of 1700 Gy at a pulse frequency of 25 Hz, and a dose per pulse of 0.92 Gy, the present invention is obvious because a skilled artisan would have recognized that this same total dose could be achieved using a dose per pulse value of 10-90

Gy, as recited in the claims, instead of the dose per pulse value of 0.92 Gy that was reported by Botman, by simply lowering the residence time according to $D = \Gamma \cdot dpp \cdot t$ formula. Applicants respectfully disagree.

Although the Examiner describes the correct relationship between dose per pulse, pulse rate and time for determining a total dose calculation, there is nothing in Botman to provide a suggestion or motivation to use a dose per pulse value of 10-90 Gy, and there is certainly no indication that any special benefit could be achieved by using a dose per pulse in the range. The fact that one of ordinary skill in the art would have had the capability to modify the method disclosed in a prior art reference is not sufficient to establish a *prima facie* case of obviousness. MPEP 2143.01. The prior art reference(s) must provide a motivation or reason for making the change asserted by the Examiner. *Ex parte Chicago Rawhide Manufacturing Co.*, 226 USPQ 438 (PTO Bd. App. 1984). Moreover, this formula fails to take into account the fact that under certain circumstances, increasing dose rate will increase the total dose required for full conversion.

It is recognized in the prior art that Styrene and MMA are not easily converted by ionizing radiation. For a free radical polymerization initiated by ionizing radiation, the total dose to achieve consistently high conversion is dependent upon the chemical system kinetics (monomer selection) and the dose rate. It is well known that as the dose rate increases, more neutral free radical species are created which greatly increases the termination rate as a square function (bimolecular) and this works against conversion. Consequently, higher the termination rate the greater the dose that is required achieve conversion and eventually this become self-defeating. Thus, as the dose rate increases the dose to obtain full conversion also increases sharply, as is shown in FIG. 3 of the present specification. For this reason, conventional, continuous electron beam techniques have not been very effective to polymerization because the high dose rate advantage over, for example UV, is lost to the higher rates of termination.

By contrast, Applicants have made the unexpected and surprising discovery that when the dose rate is kept low and the pulse rate is very high the termination rate does not increase as sharply. The high pulse rate allows just enough time between pulses for the system to polymerize in the heterogeneous mode without the need to create a two-phase heterogenous system. Good conversion is thus achieved at a high pulse rate, even at a low dose per pulse, because the beam is off during most of that time allowing the free radicals to be maintained in isolation, which is what

allows for fast polymerization (decreased termination). This relationship is not in any way taught or suggested by Botman, or elsewhere in the prior art. It is a totally new, highly efficient and unexpected way to achieve, for example, the advantage of heterogeneous polymerization in a homogenous system. There is no precedence for this in the prior art, and therefore, the claimed invention is patentable over the cited references.

For these reasons, the simple formula relied upon by the Examiner is not enough to render the present invention obvious because it is not only the total dose that effects the polymerization, but also the way in which the dose is delivered. It is not a just a matter of increasing the dose per pulse, as suggested by the Examiner, because as the pulse rate increases the dose needed to achieve full conversion also increases. Thus, one of skilled in the art would not have been motivated simply to increase the dose per pulse as suggested by the Examiner since the result would be to increase the dose required to achieve the same level of conversion.

Claims 2-4, 6-9, 14, and 15 also stand rejected under 35 USC § 103(a) as being unpatentable over Botman in view of WO 00/04055. The Examiner asserts that WO 00/04055 discloses the additional limitations recited in dependent claims 2-4, 6-9, 14, and 15 that are not disclosed in the Botman. Since, for the reasons discussed in detail above, independent claim 1 is patentable over Botman, claims 2-4, 6-9, 14, and 15, all of which depend directly or indirectly from claim 1, are likewise patentable for the same reasons previously discussed.

In summary, Applicants respectfully submit that the rejection of claims 1-17 under 35 USC § 103(a) as being unpatentable over Botman alone or in view of WO 00/04055 has been overcome and should be withdrawn.

Conclusion

In view of the foregoing remarks, Applicants respectfully submit that the application is in condition for allowance. Reconsideration of the application is requested.

All communications in this case should be direct to the undersigned. If the Examiner believes a telephone discussion would be helpful to resolve any of the outstanding issue in this case, the Examiner is encouraged to call the undersigned at the number listed below.

Respectfully submitted,

Application No.: 09/853217 Case No.: 55944US002

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